Development of a collective Thomson scattering system for high-Z plasmas for Beyond-EUV lithography

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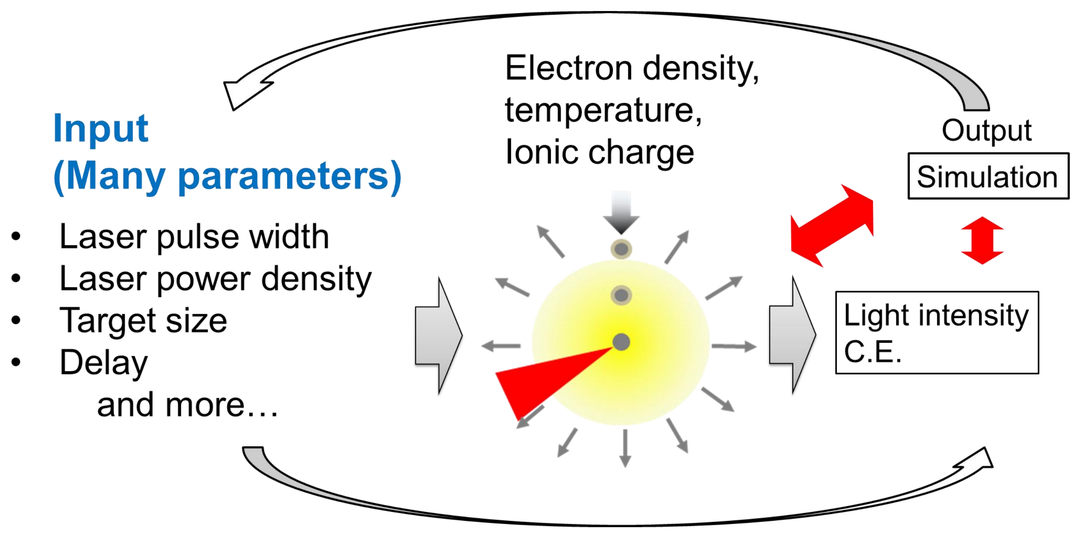
Background

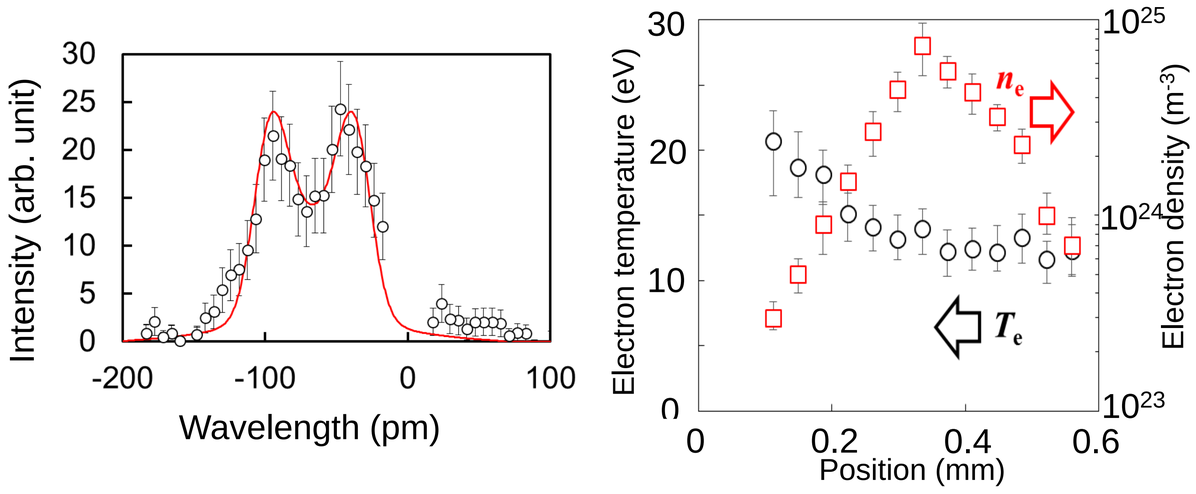


We have developed LTS system for EUV light sources

It's insufficient for B-EUV (High-Z plasmas)

Laser Thomson Scattering (LTS)

In the case of EUV plasma



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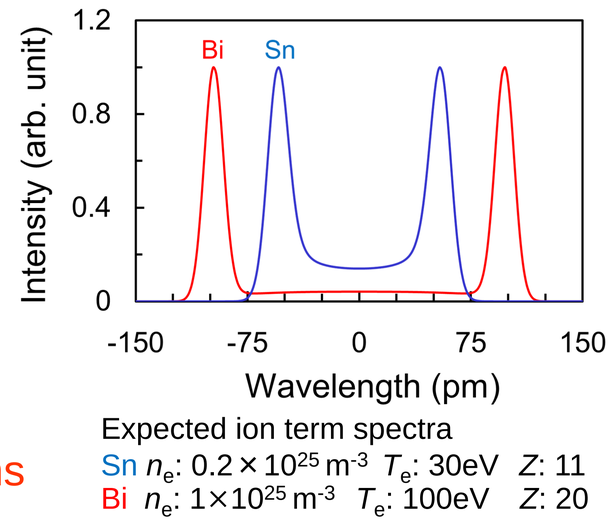
Three parameters were obtained from only ion term

In the case of high-Z plasma

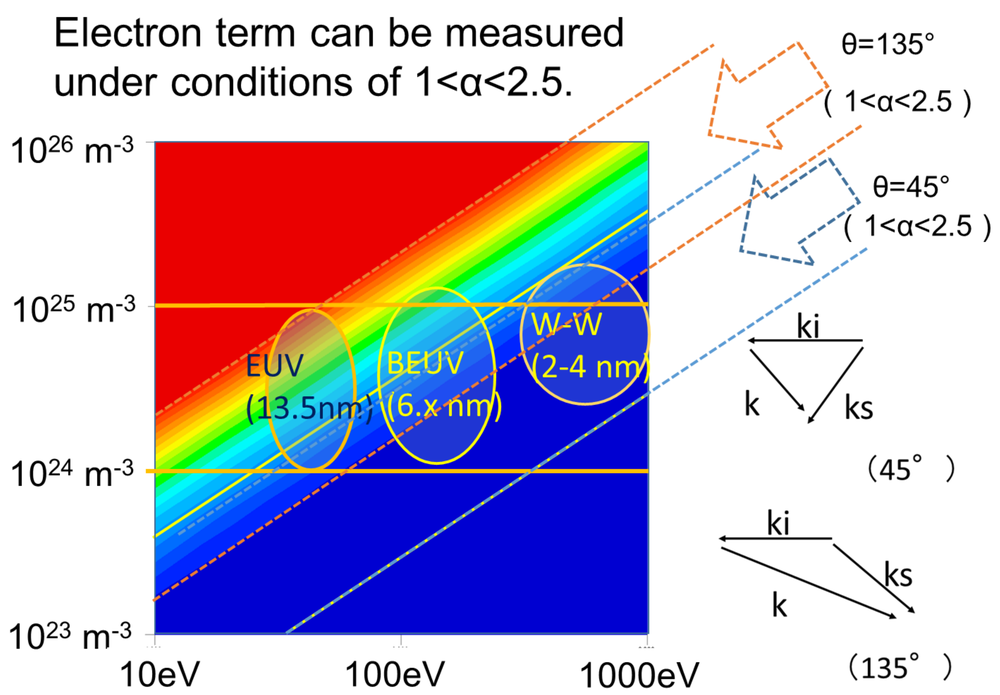
- **Ion term**
  - Intensity → n_e
  - Spectral width → $T_e \times Z$
  - ~~Spectral shape~~
- **Electron term**
  - Spectral width → n_e
  - Spectral shape → T_e

Measure n_e, T_e, Z from two terms

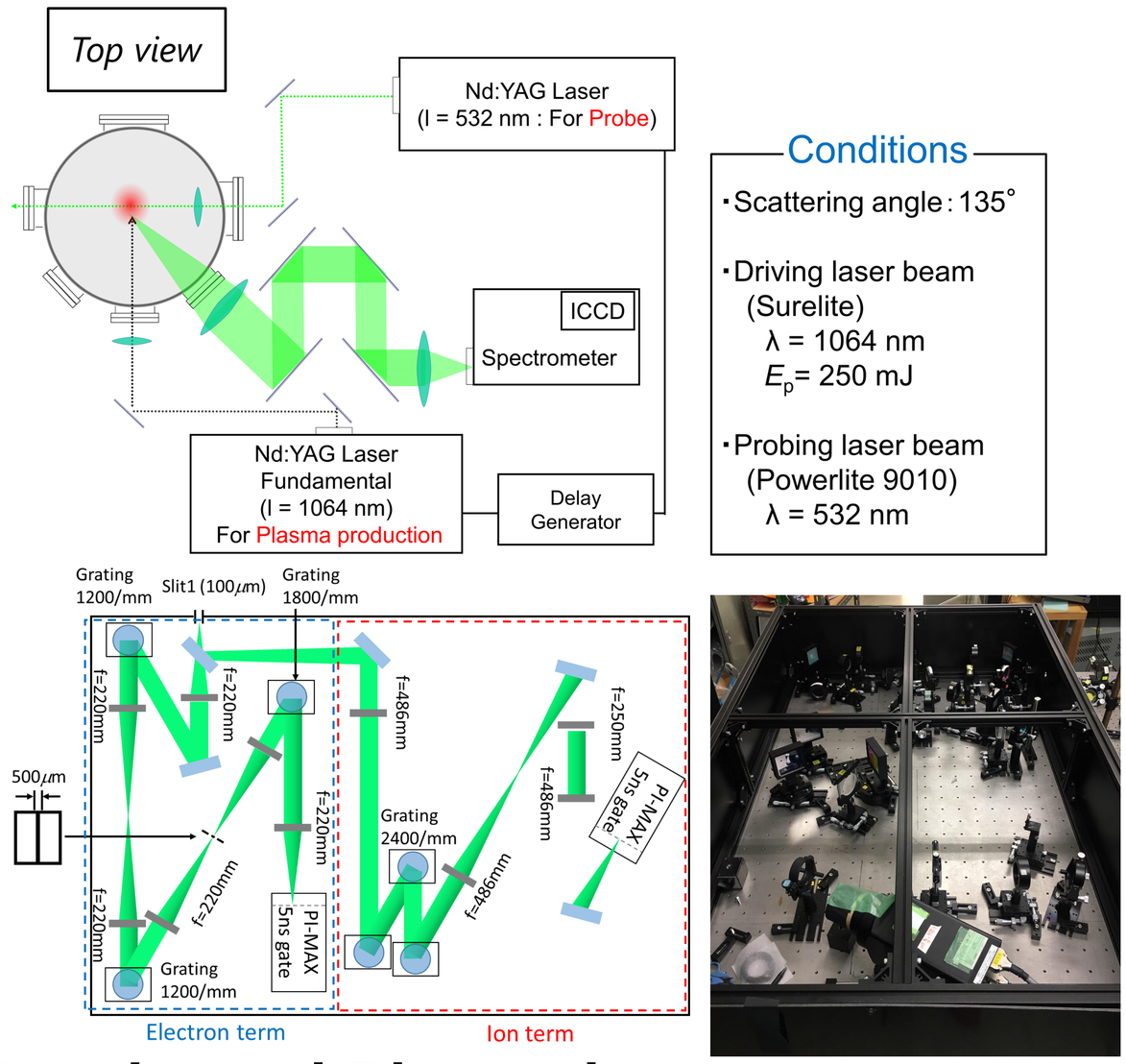


Expected ion term spectra
Sn n_e: 0.2×10^{25} m^{-3} T_e: 30eV Z: 11
Bi n_e: 1×10^{25} m^{-3} T_e: 100eV Z: 20

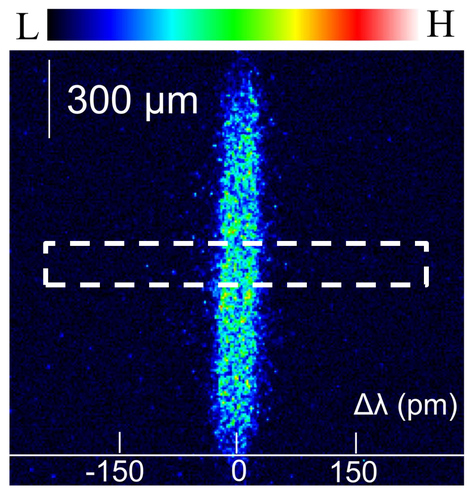
Expected parameters of the high-Z plasmas



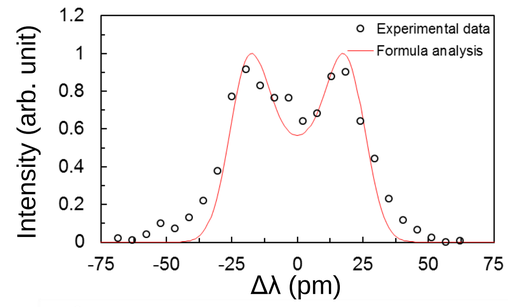
Experimental setup

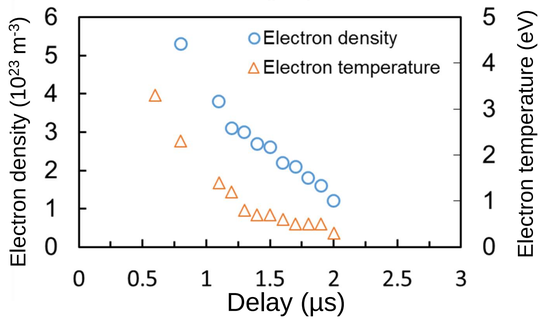


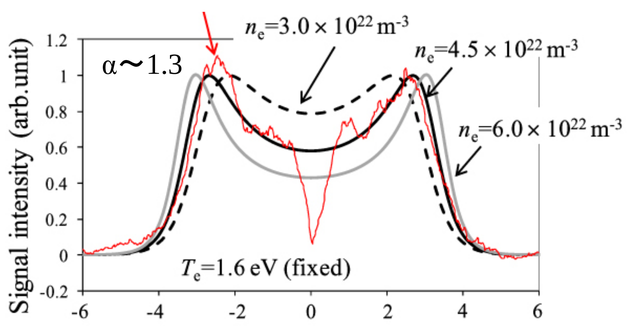
Results and Discussion

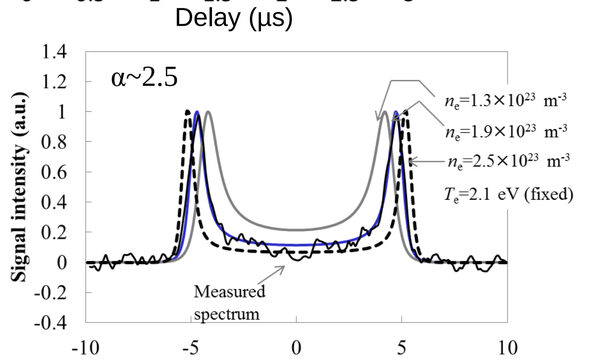


Ion term (t=1.5μs)









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We successfully measured electron feature spectra at the range of 1-2.5.

Conclusion

For development of the new LTS diagnostic systems for next generation laser-produced light source plasmas, we are planning to observe the ion term and the electron term simultaneously.
Considering S_e, clear electron terms are expected only in the range of 1<α<2.5.
By changing the scattering angle, it is possible to control a parameter in 1-2.5 for plasmas parameters, which are expected for laser-produced light sources.
For the preliminary experiment, we measured n_e and T_e of laser produce plasmas produced in the air. Now we are trying to diagnose he discharge plasmas.